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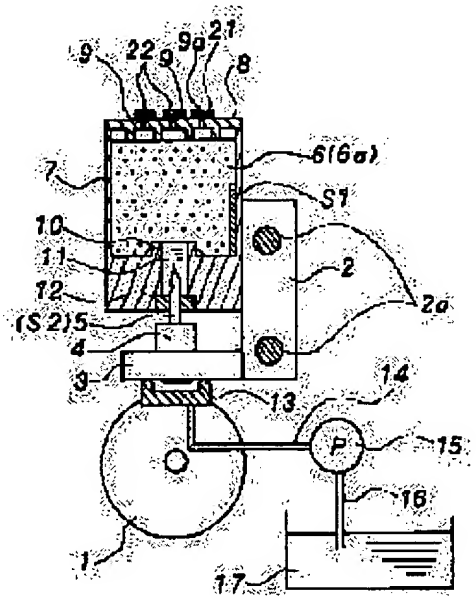
## (54) MANUFACTURE OF INK JET RECORDER AND INK TANK

(57)Abstract:

PURPOSE: To make the supply of deaerated ink by using a leak-free ink tank by providing a sealing member in a hole communicating with the outside.

CONSTITUTION: An ink tank 7, having one to multiple communication holes 9 communicating with the outside, an ink fountain 6, sealing members 21, 22 communicating with an ink chamber 11 and a recording head 3, the steam permeation rate being 2000g/m2.24h.atm or under corresponding to the communication hole 9, at least one of which has a gas permeation rate of 100cc/m2.24 h.atm or more, and at least one of which can be opened and closed, is enclosed in a sealed vessel in a decompressed state with a spacer provided between the ink tank 7 and the sealed vessel.

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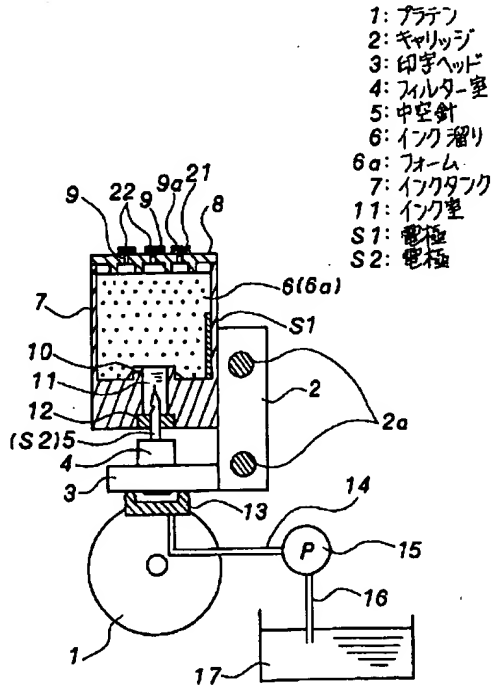
(54)【発明の名称】　インクジェット記録装置及びインクタンクとその製造方法

(57)【要約】

【目的】　外部と連通する連通孔に封止部材を設けてインクの漏れがないインクタンクを用いて脱気インクを供給する。

【構成】　外部と連通する連通孔９を１個乃至複数個有し、インク溜り６を有し、隣接して設けたインク室１１と記録ヘッド３を連通し、前記連通孔９に対応して水蒸気透過度が2000g/m$^2$・24h・atm以下で、かつ少なくとも１つがガス透過度100cc/m$^2$・24h・atm以上であって、少なくとも１つが開閉可能である封止部材２１，２２を有するインクタンク７を、前記インクタンク７と密封容器の間にスペーサを配して減圧状態で前記密封容器内に包装する。



【特許請求の範囲】

【請求項１】　記録ヘッドにインクを供給するインクタンクにおいて、

前記インクタンクは、インク溜りと、該インク溜りと前期記録ヘッドを連通する連通部と、大気と連通するが如く穿たれた連通孔と、該連通孔を封止する水蒸気透過度が2000g/m$^2$·24h·atm以下であり、かつガス透過度が100cc/m$^2$·24h·atm以上の封止部材とを有し、前記連通孔近傍に空間を保持するように気密性容器に減圧状態で密閉されていることを特徴とするインクタンク。

【請求項２】　前記連通孔を複数有し、全ての前記連通孔が水蒸気透過度が2000g/m$^2$·24h·atm以下の封止部材により封止され、少なくとも一つの連通孔が水蒸気透過度が2000g/m$^2$·24h·atm以下であり、かつガス透過度が100cc/m$^2$·24h·atm以上の封止部材により封止されていることを特徴とする請求項１記載のインクタンク。

【請求項３】　前記封止部材の少なくとも１つが開封可能であることを特徴とする請求項１乃至２記載のインクタンク。

【請求項４】　前記封止部材が樹脂からなることを特徴とする請求項１乃至３記載のインクタンク。

【請求項５】　前記開封可能な封止部材が剥離により開封可能であることを特徴とする請求項３乃至４記載のインクタンク。

【請求項６】　前記開封可能な封止部材の一部が前記気密性容器と接合されていることを特徴とする請求項５記載のインクタンク。

【請求項７】　前記開封可能な封止部材が突起により破ることが可能な部材よりなることを特徴とする請求項３記載のインクタンク。

【請求項８】　前記空間がスペーサにより形成されていることを特徴とする請求項１または２記載のインクタンク。

【請求項９】　前記インクタンクが複数色のインクを収納可能に分割して形成され、各色に応じた前記連通孔を有し、１枚の前記封止部材により前記各色の連通孔を封止していることを特徴とする請求項１乃至３記載のインクタンク。

【請求項１０】　インク溜りと、該インク溜りと記録ヘッドを連通する連通部と、大気と連通するが如く穿たれた複数個の連通孔と、該連通孔を封止する封止部材とを有するインクタンクの製造方法であって、

Ａ．前記連通孔を通じて前記インク溜りを減圧する工程

Ｂ．インクを前記連通孔から前記インクタンクに供給し充填する工程

Ｃ．水蒸気透過度が2000g/m$^2$·24h·atm以下であり、かつ、ガス透過度が100cc/m$^2$·24h·atm以上である封止部材を、前記連通孔に大気圧下で封止する工程

Ｄ．前記インクタンクを通気性のない容器内に入れ、前記連通孔と前記密閉容器の間に空間を設け、前記容器内を減圧し密封包装する工程を有することを特徴とするインクタンクの製造方法。

【請求項１１】　インクジェット記録ヘッドと、該記録ヘッドに脱着可能なインクタンクとを有するインクジェット記録装置において、

前記インクタンクは、インク溜りと、該インク溜りと前期記録ヘッドを連通する連通部と、外部と連通するが如く穿たれた連通孔と、該連通孔を封止する水蒸気透過度が2000g/m$^2$·24h·atm以下であり、かつガス透過度が100cc/m$^2$·24h·atm以上の封止部材とを有していることを特徴とするインクジェット記録装置。

【請求項１２】　前記連通孔を複数有し、全ての前記連通孔が水蒸気透過度が2000g/m$^2$·24h·atm以下の封止部材により封止され、少なくとも一つの連通孔が水蒸気透過度が2000g/m$^2$·24h·atm以下であり、かつガス透過度が100cc/m$^2$·24h·atm以上の封止部材により封止されていることを特徴とする請求項１２記載のインクタンク。

【請求項１３】　前記封止部材の少なくとも一つを大気に開放する突起部材をインクタンク取り付け部材に備えたことを特徴とする請求項１１乃至１２記載のインクジェット記録装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、インクを保持するインクタンクに関し、より詳細にはインクジェット記録装置等に適したインクタンクに関する。

【０００２】

【従来の技術】インクジェット記録装置は、記録情報に応じた文字などを、微細なノズルよりインク滴を吐出させ、記録紙上に記録書き込みを行う装置である。インク滴の形成は、記録ヘッド内部に配設された圧力室を電気歪振動子または電気熱変換素子等により急激に容積変化させ、吐出圧力を発生することにより行われる。そのため、圧力室等のインク供給経路内に空気が混入した場合には、吐出圧力が良好に発生せず、記録書き込みが不能となる。

【０００３】また、インクタンク内のインクが消費され尽くして供給が断たれると、記録書き込みが不能になる。そして、ノズルに至るインク供給経路内に空気が入り込み、インクを新たに補給しても記録書き込みが可能になるまでに、多大の時間がかかってしまうといった問題が生じる。

【０００４】もとより、このような問題に対処するために、インクタンク内にレベル検出器を配設し、またはインク供給経路の一部にレベル検出器を配設しインクの供給が断たれる前にインクエンドを検出する構成が用いられている。それによりインクエンド時にインク供給経路内に空気が大量に混入することを防止している。しかしながらインクタンクの交換時等のインクタンクと記録ヘッドとの抜き差し時にインク供給経路内に空気が混入す

ることを完全に防止することはできない。

【０００５】そこで従来よりインク供給経路内に混入した空気の影響を、インクタンクと記録ヘッドとの抜き差し時に初期的に抑えるための提案として、特公平３－６１５９２号公報に記載されたものなどが知られている。ガスバリア性の極めて高い密封容器内に、脱気したインクを収容したインクタンクを減圧状態で収容したものである。本従来例では、密封容器を開封直後はインクタンク内のインクは脱気インクとなっており、この脱気インクによりインク供給経路内に混入した空気の影響を初期的に除去しようとするものである。

【０００６】またインクタンクには、インクを充填するための注入孔や、インクの使用による減少に対応して空気が流入するように、大気と連通するための通気孔を有する。インクタンク内に充填されたインクは輸送時のインクタンクの姿勢、環境温度等の要因により、この注入孔や通気孔から漏れてしまう。特にインクタンクを減圧包装した場合、高い減圧状態にするほどこの現象は顕著となる。そのために特開平４－１２８３４号公報に記載されたもののように、減圧包装時の真空度をインクを充填する際より低い減圧状態にして減圧包装する方法が提案されている。

【０００７】また従来よりインクの漏れを防止するために、特公昭５４－３１８９７号公報に記載されたものなどが知られている。空気の通過は許すが液体の流れるのを防ぐ、無数の狭い貫通した通路を有するポリテトラフルオルエチレンのようなフィルタを通気孔に有する。その他に、特開昭６０－２４５５６０号公報や米国特許第４７７１２９５号明細書に示されるように、インクタンク中に空間を設けるものが知られている。

【０００８】

【発明が解決しようとする課題】しかし従来例では、減圧が大きければ大きいほどインクの脱気度は保たれ、信頼性は確保できるにもかかわらず、減圧が大きくなるに伴ってインクが注入孔から漏れやすくなる。また、落としたりといった衝撃を加えた後に減圧包装すると、僅かな減圧でインクが漏れるので作業性が悪い。さらに温度変化があるとインク中の気体の膨張で、インクが漏れる。インクの漏れを防止するためにインクの充填量を減らして充填効率を落とすとインクタンクが大きくなるといった問題がある。

【０００９】また漏れを防止するために示した従来例では、大気圧下ではインクの漏れはないが、十分な信頼性が確保できるだけの減圧状態で包装すると、封止部材からインクが染み出てくる。なぜならば封止部材のガス透過度が高すぎる、つまり無数の小さな孔が封止部材に存在しているフィルタであるからである。

【００１０】この封止部材にガス透過のない部材を用いるとインクの漏れはないが、減圧包装時に再脱気されることがないので、脱気インクを供給するためには、全工程を減圧下で行うもしくは大気圧下での工程を短時間で行わなければならない上に、インクが分解してガスが発生した場合再び飽和してしまうといった問題がある。

【００１１】また、インクタンク中に空間を設けたり、蓋の形状を工夫して漏れの対策をしても、高温環境下ではインク中の気体が膨張して漏れてしまい、これを完全に防ぐことは難しい上に、インクタンクが大きくなるといった問題がある。

【００１２】そこで本発明はこのような問題点を解決するものでその目的とするところは、安価で信頼性が高く小型のインクジェット記録装置を提供することにある。

【００１３】

【課題を解決するための手段】本発明のインクタンクは、記録ヘッドにインクを供給するインクタンクにおいて、前記インクタンクは、インク溜りと、該インク溜りと前期記録ヘッドを連通する連通部と、大気と連通するが如く穿たれた連通孔と、該連通孔を封止する水蒸気透過度が2000g/m$^2$･24h･atm以下であり、かつガス透過度が100cc/m$^2$･24h･atm以上の封止部材とを有し、前記連通孔近傍に空間を保持するように気密性容器に減圧状態で密閉されていることを特徴とする。

【００１４】また、本発明のインクタンクの製造方法は、インク溜りと、該インク溜りと記録ヘッドを連通する連通部と、大気と連通するが如く穿たれた複数個の連通孔と、該連通孔を封止する封止部材とを有するインクタンクの製造方法であって、

A．前記連通孔を通じて前記インク溜りを減圧する工程

B．インクを前記連通孔から前記インクタンクに供給し充填する工程

C．水蒸気透過度が2000g/m$^2$･24h･atm以下であり、かつ、ガス透過度が100cc/m$^2$･24h･atm以上である封止部材を、前記連通孔に大気圧下で封止する工程

D．前記インクタンクを通気性のない容器内に入れ、前記連通孔と前記密閉容器の間に空間を設け、前記容器内を減圧し密封包装する工程

を有することを特徴とする。

【００１５】

【作用】本発明の上記の構成によれば、減圧状態でインクの漏れがなく、かつガス透過をする封止部材の条件を見いだし、インクタンクと密封容器間に空間を設けて減圧包装したので、インクが再脱気され、それによりインクタンクの使用初期に大変信頼性の高い状態に脱気されたインクを記録装置に供給することが出来るので、インクタンクの交換時にインク供給路内に混入してしまう空気による不具合を解消する。また、減圧包装時や輸送時や保存状態でインクが漏れることがないので、インクの充填性を損なうことなく減圧包装することができる。さらにインク充填後に大気圧下で封をした後減圧包装したので、工程が簡略化される。以上より信頼性が高く小型で安価なインクジェット記録装置を提供することができ

る。

【００１６】

【実施例】以下に本発明の一実施例を図面にもとづいて説明する。

【００１７】図１は本発明のインクジェット記録装置の一実施例を説明するための主要断面図であり、図２は本発明のインクジェット記録装置に用いるインクタンクの主要部の分解斜視図である。図３は主要部の斜視図を示したものである。また図４は、インクエンド検出回路を説明するためのブロック図である。

【００１８】図３に示すように、記録紙を搬送するために矢印Ａ方向に回転する記録紙搬送手段であるプラテン１に沿って、ガイド軸２ａ上を矢印Ｂ方向に往復運動するキャリッジ２には、プラテン１に近接して記録ヘッド３が一体的に設けられている。記録ヘッド３の上方には、インク溜り６があり内部にポリウレタンフォーム等の多孔質部材よりなるフォーム６ａを収容したインクタンク７が設けられている。　図２に示すように、本実施例においてインクタンク７は６Ｙ，６Ｍ，６Ｃの３つの部屋に分割されて、インク溜り６は３つ設けられている。この部屋各々にはイエロー、シアン、マゼンタのカラーインクが充填されている。ただしインクの種類と数が設計上変わればインクタンク７内の部屋数は必要数に分割されることになる。また、インクの消費量に応じて各部屋の容積を変化させることも可能である。

【００１９】図１、２の通り、インクタンク７には、その蓋８に外部と連通する連通孔９が設けられ、またその底面にはフォーム６との密着をはかる台状の突起１０が形成されている。この突起１０の中心部から下方に向けてフォーム６内のインクを取り出し保持するインク室１１が形成されている。インク室１１の端部はゴム等の弾性部材よりなる盲栓１２により封止されている。そして、この盲栓１２にフィルタ室４を介して、記録ヘッド３と連通する連通部材である中空針５を挿通することにより、インクタンク７内に含浸したインクを記録ヘッド３に供給するように構成されている。なお、インク室１１は盲栓１２及びフォーム６により密閉室の状態になっている。また、連通孔９の少なくとも１つは開封可能な封止部材２１で使用直前までは封止されていて、使用直前に開封して通気孔９ａとなる。但し、本実施例では連通孔９は複数個設けてあるが、１つだけでも所望の効果を得るのに何等問題はない。開封するためには図２のように充分に長い封止部材２１を用い、その端部を引っ張り剥して開封する方法を用いると容易に開封できる。さらに、その端部を図６に示す包装袋２５内に接合すれば包装袋２５から取り出すときに必ず開封され、使用者の開封忘れなどの問題もなく確実に開封できる。また図５のようにインクタンクを取り付けるためのレバー３０に突起３１を設け、インクタンクを取り付けるときにレバー３０をＣ方向に倒し、この突起３１で突き破る方法を用いても容易に開封できる。但し、封止部材２１を開封できる構成であれば、特に専用の器具を用いて開封しなくてもよい。

【００２０】本発明のインクタンクは、開封しない他の連通孔９にも封止部材２２を設けてある。全ての封止部材２１，２２は水蒸気透過度が2000g/m$^2$·24h·atm以下で、かつ少なくとも１個のガス透過度は100cc/m$^2$·24h·atm以上のものを用いる。ガス透過度は、ＪＩＳ（日本工業規格）Ｋ７１２６のプラスチックフィルム及びシートの気体透過度試験方法のＡ法に乗っ取り、２３±２℃の大気の透過度を測定したものである。また水蒸気透過度は、ＪＩＳ（日本工業規格）Ｋ７１２９のプラスチックフィルム及びシートの水蒸気透過度試験方法（機器測定法）の４０±０．５℃相対湿度差（９０±２）％ＲＨの条件でＡ法に乗っ取って測定したものである。水蒸気透過度が2000g/m$^2$·24h·atm以下のものを用いる理由は、輸送時にインクが漏れないようにであり、100cc/m$^2$·24h·atm以上のものを用いる理由は、後述する減圧包装後にインクが再脱気されるようにである。水蒸気透過度が2000g/m$^2$·24h·atmでガス透過度が20000cc/m$^2$·24h·atmである厚さ１３μｍの三酢酸セルロースを封止部材に用いて実験したところ、インクは漏れることがなくインクは再脱気され、期待する効果を得ることが出来た。またガス透過度が100cc/m$^2$·24h·atmで水蒸気透過度が3g/m$^2$·24h·atmである厚さ２５μｍのビニリデンクロライドコポリマーを封止部材に用いて実験したところ、これもまたインクは漏れることがなくインクは再脱気され、期待する効果を得ることが出来た。

【００２１】ここで封止部材２１を開封して通気孔９ａを開ける理由を説明する。全ての封止部材２１，２２は水蒸気透過度が2000g/m$^2$·24h·atm以下である。このような材料のガス透過度は大きくても約1,000,000cc/m$^2$·24h·atmであり、このガス透過度では、通常のプリンタ使用のインク消費スピードに対して、インクタンク内に補充される空気量が少ないので、プリンタを使用するにつれて徐々にインクタンク内が負圧になる。この負圧が一定値を越えると、つまりヘッドのノズルに形成されるインクのメニスカスの毛細管力を越える負圧がインクタンク内に発生すると、メニスカスは破壊しインク滴の吐出不良となってしまう。従って、インクの消費に対応して空気を補充するための通気孔９ａが必要となる。

【００２２】また万一、記録ヘッド３に吐出不良が生じた場合には、キャップ１３、配管１４を介して吸引ポンプ１５を動作することで、記録ヘッド３よりインクを吸引する。それにより、吐出不良の回復動作が行われる。吸引されたインクは配管１６を通って廃インク溜１７に送られる。本発明においては、廃インク溜１７とインクタンク７とは別体であって廃インク溜１７は記録装置本体内に配設され、通常は交換されない構成になっている。

【００２３】ところで図中符号Ｓ１，Ｓ２は、インクエンド検出用の電極であって、その一方の電極Ｓ１はフォーム６と接触するようにインクタンク７の内壁面に設けられ、他方の電極Ｓ２は、インクと接触する中空針５が電極を兼ねている。電極Ｓ１とインクタンク７の間には、インクが漏れないようにゴム製のＯリング２３がかませてある。そして電極Ｓ１には、図４に示したように基準電圧Ｖｃｃが印可される。また他方の電極Ｓ２を兼ねる中空針５は接地されている。さらに基準電圧Ｖｃｃが印可されている側の電極Ｓ１には、微分回路１９と比較回路２０とからなる抵抗変化量検出回路が接続している。そして抵抗変化量がある一定レベルを越えたときに、出力信号を発生するように構成されている。

【００２４】また記録ヘッド３に印可されるインク滴吐出用の記録指令信号は、可とう性の信号伝達手段であるＦＰＣ（Ｆｌｅｘｉｂｌｅ　Ｐｒｉｎｔ　Ｃｉｒｃｕｉｔ）１８により伝達される。そしてＦＰＣ１８上にはインクエンド検出用の信号線が一体的に配線され、電極Ｓ１，Ｓ２に接続されている。なお、信号伝達手段としてＦＰＣ１８の換わりに、ＦＦＣ（Ｆｌｅｘｉｂｌｅ　Ｆｌａｔ　Ｃａｂｌｅ）等を用いても良いことはいうまでもない。さらに１枚のＦＰＣではなく、２枚重ねの構成であっても良いことはいうまでもない。

【００２５】次に本実施例に用いたインクタンクの製造及び包装方法について図６、図７により説明する。図６に示す包装袋２５はガスバリア性の極めて高いアルミラミネートフィルムで作られた包装袋である。

【００２６】まず、インクタンク７にインクを充填する方法は、インクタンク７を減圧状態にした後にインクを供給して行う。充填に用いる真空度は０．４気圧以下で所望のインク充填をすることができるが、充填インク量及び充填時間を考慮すると０．２気圧以下が望ましい。この時インクは減圧され、脱気インクとなる。この減圧状態で多孔質部材にインクを充填する方法については特開昭６０－２４５５６０号公報において説明されているように、インク充填効果は非常に高い方法である。

【００２７】次に、大気圧下で封止部材２１，２２で連通孔９を封止する。この作業及びこの作業に至るまでの過程も減圧状態下で行えればよいのであるが、インクを充填したインクタンク７を大気圧下に放置してインクが飽和して、大気圧下で封をしても、封止部材の少なくとも一つには100cc/m$^2$·24h·atmのガス透過性があるので、次の工程の減圧包装後にインクは再脱気される。封止方法には溶着もしくは接着材による方法などを用いることが出来るが、インクの漏れを防ぐためには溶着の方が望ましい。接着材を用いる場合、漏れを防ぐための接着力と剥離性、インクに犯されないといった特性を満足する必要がある。封止部材２１，２２は、分子レベルの空気を透過する膜であるから、樹脂を用いてその厚みや積層でガス透過度や水蒸気透過度をコントロールすれば材料の選定が容易である。例えばインクタンク７にポリスチレン樹脂を、封止部材２２にガス透過度が約2500cc/m$^2$·24h·atmのポリスチレン樹脂４０μｍのフィルムを、開閉可能な封止部材２１に100cc/m$^2$·24h·atm以下のポリスチレン樹脂３０μｍとポリエチレン樹脂２０μｍとポリエチレンテレフタレート樹脂１２μｍの３層積層フィルムを用いて溶着にて封をした場合、ガス透過度、水蒸気透過度、接合力、剥離性、強度的に充分期待する効果が得られた。

【００２８】次に、図７のようにインクタンク７とスペーサ２８を包装袋２５に入れ減圧した後、完全に密封シールする。インクタンク７と包装袋２５の間には空間２９がある。この空間はインクタンク７の中より真空度が高くなっているので、ガス透過度が100cc/m$^2$·24h·atm以上の封止部材を介してインクは再脱気される。さらにインクタンク７の輸送中や保存中にインクが分解して窒素や酸素などのガスが発生しても脱気される。スペーサ２８に段ボールやウレタンフォームのように空気を透過し、かつその内部に空間が存在する部材を用いれば、もし連通孔９にスペーサ２８が密着しても部材内の空間が空間２９の役割を果たす。そのためスペーサ２８の形状を簡単にすることができ、スペーサ２８の製造や組立が容易になる。減圧包装時の真空度は０．６気圧以下であれば真空に近ければ近いほどよい。次に梱包箱２７（不図示）に収納される。この状態で包装袋２５のシール部２６は梱包箱２７との間にあって緩衝材を兼ねている。そのため特別な緩衝部材を用いる必要はない。

【００２９】ここで、減圧包装時の真空度と減圧包装状態における保存期間後の窒素量との関係を説明する。大気中には窒素以外の気体も存在するが、窒素量が最も大きいため窒素量がコントロールできればよい。

【００３０】実験によれば表１に示すように密封シール時の真空度を制御することにより、包装を開封した直後のインクタンク７内のインクの脱気度を制御することが出来る。

【００３１】

【表１】

| 真空度（気圧） | 窒素量（％） |
|---|---|
| ０．５ | ６０～７０ |
| ０．３５ | ５５～６５ |
| ０．２ | ４５～６０ |

【００３２】表１中の窒素量は、飽和値に対するインク中に溶けている窒素量のパーセンテージで示してあり、本実施例に用いたインクの場合には、飽和値は１０～１１ｐｐｍ程度であった。次に製造時と開封後にインクタ

ンク７内のインクの脱気度がどの様に変化するかをインク中の窒素量により説明する。実験によれば図８に示すように図中ｂまでの期間は、インクを充填した直後から大気圧状態に放置して減圧包装するまでの期間である。インクを充填した直後から期間ａまでは約３日である。減圧包装して期間ｃまでの間、ガス透過度が大きい封止部材２２もしくは２１を通して徐々にインクタンク７内のインクは脱気される。0.00001m$^2$の連通孔９に封止部材で封止したとき、減圧包装後一定の窒素量になるまでにかかる期間とガス透過度の関係は、実験によると表２のようになっており、ガス透過度が大きいほど短い期間でインクタンク中のインクは再脱気される。

【００３３】

【表２】

| ガス透過度（cc/㎡･24h･atm） | 期間（日） |
|---|---|
| １００ | ６０～７０ |
| ２５００ | ３～５ |
| １００００ | １～２ |

【００３４】ガス透過率が100cc/m$^2$･24h･atm以下の封止部材を用いると、再脱気される期間が長くなり輸送期間や保管期間を考慮にいれた場合、使用時には充分脱気されていない事が考えられるので実用上問題がある。輸送期間が短くかつガス透過度が小さい封止部材を用いる場合は、充填した後封止部材２１，２２で封をするまで大気圧下に放置しておく時間を短くすれば、再脱気される期間も短くなり使用時には充分な信頼性を確保することが出来る。もしくは封止部材２１，２２で封をするとき、に少しだけでも真空度のある環境下で封をすればよい。この場合インクタンク７内と空間２９の圧力差が小さくなるので、封止部材２１，２２の接合強度が小さくても剥がれることがないという効果がある。

【００３５】図中ｃからｄまでの期間は包装状態での保存期間である。実験では２年間を想定した。そして開封後の図中ｄ時点より順次窒素量は上昇する。インク中の窒素量は、開封後３日程で図中ｅの略飽和状態に達する。しかしながら実験によると、脱気による効果は図中ｄの開封後から２～４週間程度期待できることがわかった（図中ｆ）。その後は完全飽和状態となり、本発明で所望するインクの脱気の効果はなくなる。

【００３６】ここでインクの脱気による効果について説明する。インクタンク７を中空針５に対して抜き差しする際に、中空針５より混入する空気の量は、通常は非常に微量である。実験による確認では、中空針５のインク流入口径が直径０．８ｍｍ程度の時、混入する空気の量は、多くてもメニスカス分の０．４立方ｍｍ程度以下であった。一度混入した空気は記録ヘッド３に向かって流れ、フィルタ室４内のフィルタ４ａ（不図示）に到達しトラップされる。このトラップされた空気はフィルタ４ａの目粗さが非常に微細なため容易にフィルタ４ａを通過することはない。実験によればフィルタ４ａの直径が４ｍｍ、フィルタ室４内の空間幅が０．３～０．５ｍｍ程度の時にインクタンク７の抜き差し回数が１０～数１０回行なっても記録動作によって該空気がフィルタ４ａを通過することはなかった。この程度の空気の混入であれば図８中ｅまでの期間中は、明らかに脱気インクを記録ヘッド３に供給することができ、それによりインクタンク７を中空針５に対して抜き差しする際に、中空針５より混入した空気はインクにとけ込み問題とはならない。しかしながら実使用においては中空針５よりインクタンク７を外したまま放置される場合などは充分に有り得る。この場合には大量に空気が混入する。大量に空気が混入すると混入した空気はフィルタ４ａをふさぎインクの通過を妨げてしまう。その結果として記録ヘッド３は吐出不良となる。この場合には吸引ポンプ１５を動作して吐出不良の回復動作を行うのであるが、インクの脱気度によって回復性に大きな差があることも実験によりわかった。図８中ｆで示す開封後２～４週間程度までのインクであれば、フィルタ室４内の空気を吸引ポンプ１５により吸引除去するのに何ら不具合はない。ところがこの期間を過ぎるとインク中の空気量は完全飽和、さらには過飽和状態となり、空気と共にフィルタ４ａを通過するとフィルタ４ａから記録ヘッド３にかけて微小気泡が発生することが確認された。この微小気泡が記録ヘッド３の圧力室にある場合には吐出不良となってしまう。

【００３７】以上説明したようにインクタンク７の交換時に混入する空気に対しては、インクの脱気の効果により吐出不良となるような不具合をなくすことが出来る。またフィルタ室４内に多量に空気が溜った場合に行う回復動作においてもインクの脱気の効果により、良好に回復動作を終了することができる。フィルタ室４内の空気量が一定以下であれば空気がインクと共にフィルタ４ａを通過しないため、図８中ｅ以降の飽和状態となったインクであっても回復動作時になんら不具合はない。

【００３８】

【発明の効果】本発明によれば、インクタンク内のインクが漏れることがないので、インクの充填性を損なう事なくインクをインクタンクに収容したまま減圧包装することができる。インクタンクの連通孔に設けた封止部材にはガスが透過し、さらにインクタンクと包装容器の間には真空度の高い空間が存在するのでインクは再脱気される。それによりインクタンクの使用初期に脱気インクを記録装置に供給することができ、インクタンクの交換時にインク供給経路内に混入してしまう空気による不具合を解消する。またインクタンクを封止する封止部材の開封が容易である。以上により極めて信頼性が高く小型

で安価なインクジェット記録装置を提供できるという効果を有する。

【図面の簡単な説明】

【図１】本発明のインクジェット記録装置の一実施例を説明するための主要断面図。

【図２】本発明のインクジェット記録装置に用いるインクタンクの主要部の分解斜視図。

【図３】本発明のインクジェット記録装置の主要部の斜視図。

【図４】インクエンド検出回路を説明するためのブロック図。

【図５】本発明のインクジェット記録装置の主要部の斜視図。

【図６】減圧包装されたインクタンクを説明するための斜視図。

【図７】減圧包装容器内を説明するための断面図。

【図８】窒素透過量と時間の関係を示した図。

【符号の説明】

１　・・・・プラテン

２　・・・・キャリッジ

３　・・・・記録ヘッド

４　・・・・フィルタ室

５　・・・・中空針

７　・・・・インクタンク

９　・・・・連通孔

９ａ・・・・通気孔

１３・・・・キャップ

１５・・・・吸引ポンプ

１７・・・・廃インク溜

１９・・・・微分回路

２０・・・・比較回路

２１・・・・開封可能な封止部材

２２・・・・封止部材

２５・・・・包装袋

２６・・・・シール部

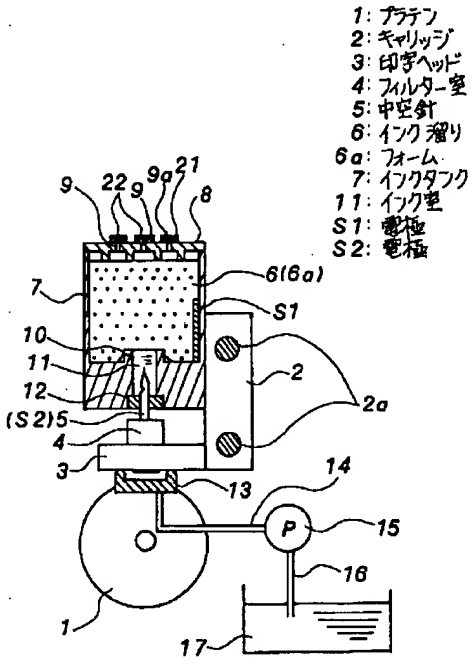
２８・・・・スペーサ

２９・・・・空間

Ｓ１・・・・電極

Ｓ２・・・・電極

【図１】

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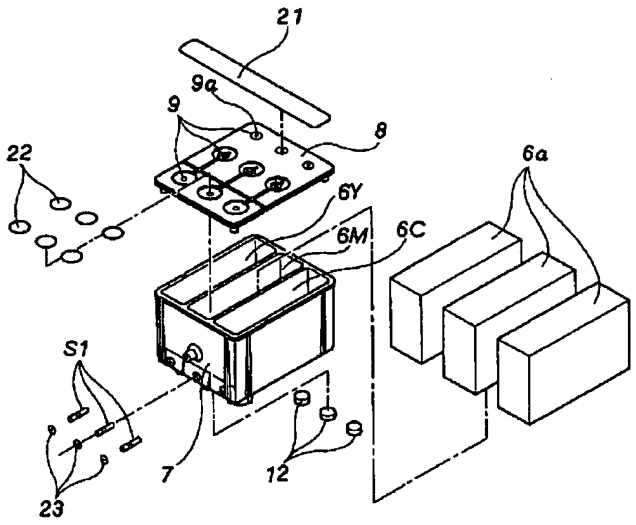


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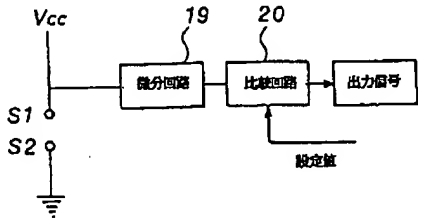

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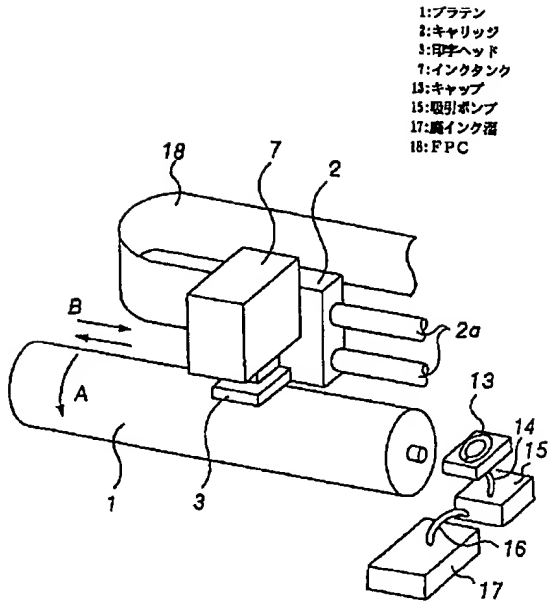
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B
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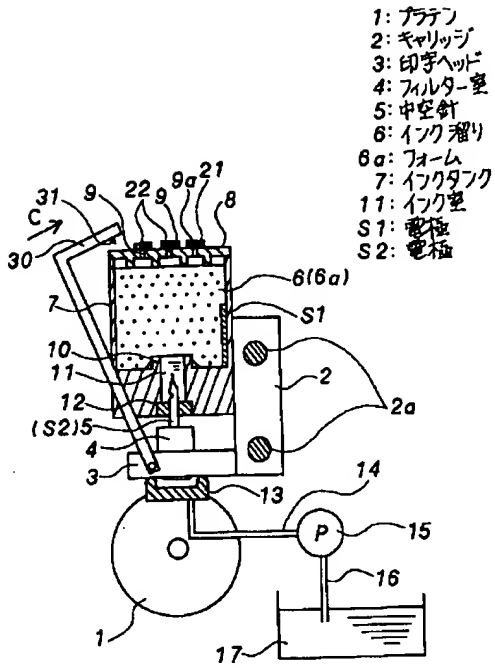
13
14
15
1
3
16
17

【図５】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7: インクタンク
11: インク室
S1: 電極
S2: 電極
31
9
22
9a
21
8
C
30
6(6a)
7
S1
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P
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1
17

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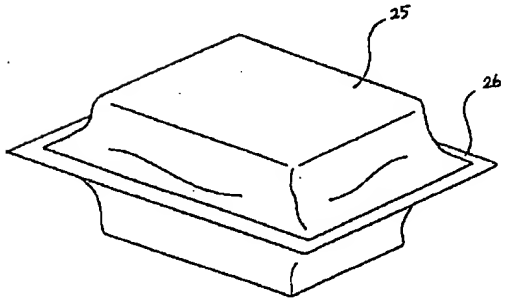
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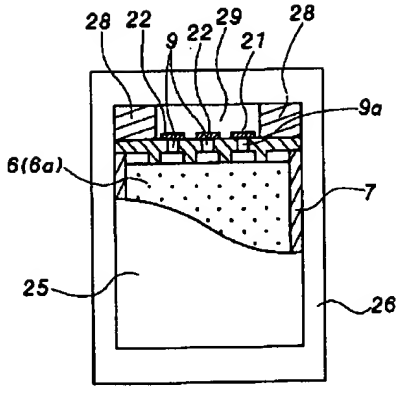
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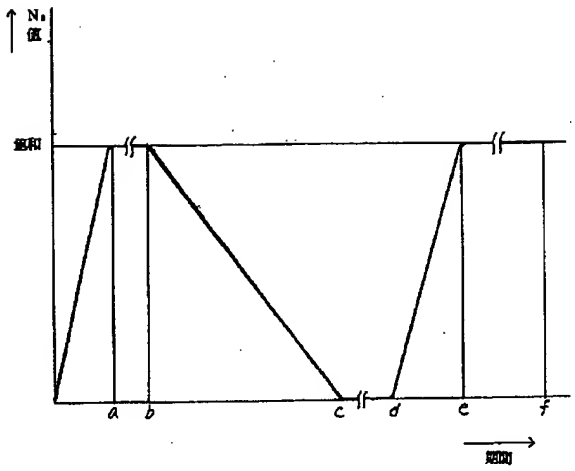

## CLAIMS

[Claim(s)]
[Claim 1] In the ink tank which supplies ink to a recording head said ink tank Ink ****, this ink ****, and the free passage section that opens a recording head for free passage in the first half, The steam transmittance which closes the free passage hole dug so that it might be open for free passage with atmospheric air, and this free passage hole is less than [ 2000 g/m2.24 h-atm ]. And the ink tank characterized by being sealed by the airtight container in the state of reduced pressure so that gas transmittance may have a closure member beyond 100 cc/m2.24 h-atm and may hold space near [ said ] the free passage hole.
[Claim 2] The ink tank according to claim 1 characterized by having two or more said free passage holes, and steam transmittance being closed for said all free passage holes by the closure member not more than 2000 g/m2.24 h-atm, for steam transmittance being [ for at least one free passage hole ] less than [ 2000 g/m2.24 h-atm ], and gas transmittance being closed by the closure member 100 cc/m2.24h and more than atm.
[Claim 3] The ink tank according to claim 1 to 2 characterized by the ability to open at least one of said the closure members.
[Claim 4] The ink tank according to claim 1 to 3 characterized by said closure member consisting of resin.
[Claim 5] The ink tank according to claim 3 to 4 characterized by the ability of the closure member in which said opening is possible to open by exfoliation.
[Claim 6] The ink tank according to claim 5 characterized by joining a part of closure member in which said opening is possible to said airtight container.
[Claim 7] The ink tank according to claim 3 characterized by consisting of a member which can be broken by projection by the closure member in which said opening is possible.
[Claim 8] The ink tank according to claim 1 or 2 characterized by forming said space by the spacer.
[Claim 9] The ink tank according to claim 1 to 3 characterized by for said ink tank dividing the ink of two or more colors possible [ receipt ], forming it, having said free passage hole according to each color, and closing the free passage hole of each of said color by said closure member of one sheet.
[Claim 10] Ink ****, this ink ****, the free passage section that opens a recording head for free passage, and two or more free passage holes dug so that it might be open for free passage with atmospheric air, It is the manufacture approach of an ink tank of having the closure member which closes this free passage hole. A. The process C. steam transmittance which supplies and fills up said ink tank with the process B. ink which decompresses said ink **** through said free passage hole from said free passage hole is below 2000g[/m ]2.24h and atm. And the closure member whose gas transmittance is more than 100 cc/m2.24 h-atm The manufacture approach of the ink tank characterized by having the process which puts in the process D. aforementioned ink tank closed under atmospheric pressure to said free passage hole in a container without permeability, prepares space between said free passage holes and said well-closed containers, decompresses the inside of said container, and carries out a seal package.
[Claim 11] It is the ink jet recording device which the steam transmittance which closes the free passage hole dug so that it might be open for free passage with the free passage section in which

said ink tank opens a recording head for free passage ink **** , this ink **** , and the first half in the ink jet recording device which has the ink tank in which desorption is possible in an ink jet recording head and this recording head , and the exterior , and this free passage hole is less than [ 2000 g/m2.24 h-atm ] , and is characterize by gas transmittance have the closure member beyond 100 cc/m2.24 h-atm .

[Claim 12] The ink tank according to claim 12 characterized by having two or more said free passage holes, and steam transmittance being closed for said all free passage holes by the closure member not more than 2000 g/m2.24 h-atm, for steam transmittance being [ for at least one free passage hole ] less than [ 2000 g/m2.24 h-atm ], and gas transmittance being closed by the closure member 100 cc/m2.24h and more than atm.

[Claim 13] The ink jet recording device according to claim 11 to 12 characterized by equipping an ink tank attaching member with the height material which opens at least one of said the closure members to atmospheric air.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the ink tank which fitted the ink jet recording device etc. at the detail more about the ink tank holding ink.

[0002]

[Description of the Prior Art] An ink jet recording device is equipment which is made to breathe out an ink droplet for the alphabetic character according to recording information etc. from a detailed nozzle, and performs record writing in the record paper. Formation of an ink droplet carries out volume change of the pressure room arranged in the interior of a recording head rapidly by electrostriction vibrator or the electric thermal-conversion component, and is performed by generating a discharge pressure. Therefore, when air mixes in ink supply paths, such as a pressure room, a discharge pressure does not occur good but record writing becomes impossible.

[0003] Moreover, record writing will become impossible, if all the ink in an ink tank is consumed and supply is cut off. And air enters in the ink supply path of resulting in a nozzle, and the problem of taking great time amount by the time record writing is attained, even if it newly supplies ink arises.

[0004] In order to cope with such a problem from the first, before arranging a level detector in an ink tank, or arranging a level detector in a part of ink supply path and cutting off supply of ink, the configuration which detects an ink end is used. It has prevented that air mixes in a large quantity in an ink supply path by that cause at ink and the time. However, it cannot prevent thoroughly that air mixes in an ink supply path at the time of extraction and insertion with the ink tanks at the time of exchange of an ink tank etc., and a recording head.

[0005] Then, what was indicated by JP,3-61592,B is known as a proposal for suppressing the effect of the air conventionally mixed in the ink supply path in first stage at the time of extraction and insertion with an ink tank and a recording head. The ink tank which held the deaerated ink in the very high hermetic container of gas barrier property is held in the state of reduced pressure. In this conventional example, immediately after opening a hermetic container, the ink in an ink

tank is deaeration ink, and it is going to remove the effect of the air mixed in the ink supply path in this deaeration ink in first stage.
[0006] Moreover, on an ink tank, it has an injected hole for being filled up with ink, and an air hole for being open for free passage with atmospheric air so that air may flow corresponding to reduction by the activity of ink. The ink with which it filled up in the ink tank will leak from this injected hole and air hole according to factors, such as a position of the ink tank at the time of transport, and environmental temperature. When vacuum packaging especially of the ink tank is carried out, this phenomenon becomes remarkable, so that it changes into a high reduced pressure condition. Therefore, although indicated by JP,4-12834,A, the approach of carrying out and changing vacuum packaging of the degree of vacuum at the time of vacuum packaging into a reduced pressure condition lower than the time of being filled up with ink like is proposed.
[0007] Moreover, in order to prevent the leakage of ink conventionally, what was indicated by JP,54-31897,B is known. Although passage of air is allowed, it has a filter like the poly tetrafluoroethylene which has the penetrated countless narrow path which prevents a liquid flowing in an air hole. In addition, as shown in JP,60-245560,A or a U.S. Pat. No. 4771295 description, what prepares space into an ink tank is known.
[0008]
[Problem(s) to be Solved by the Invention] However, the more, in the conventional example, the more reduced pressure is large, although dependability is securable, reduced pressure follows it on becoming large, and ink leakage-comes to maintain whenever [ deaeration / of ink ], and to be easy of dependability from an injected hole. Moreover, if vacuum packaging is carried out after adding the impact of being as drop ****, since ink will leak by slight reduced pressure, workability is bad. If there is furthermore a temperature change, ink will leak by expansion of the gas in ink. In order to prevent the leakage of ink, when the fill of ink is reduced and a charging efficiency is dropped, there is a problem that an ink tank becomes large.
[0009] Moreover, in the conventional example shown in order to prevent leakage, although there is no leakage of ink under atmospheric pressure, if it packs only in the state of the reduced pressure which can secure sufficient dependability, ink will ooze from a closure member. The gas transmittance of a closure member is too high, that is, it is because it is the filter with which the countless small hole exists in the closure member.
[0010] Since it will not be re-deaerated at the time of vacuum packaging although there is no leakage of ink if the member which does not have gas transparency in this closure member is used, in order to supply deaeration ink, or it performed all processes under reduced pressure, when the process under atmospheric pressure must be performed upwards for a short time, ink decomposes and gas occurs, there is a problem that it will be saturated again.
[0011] Moreover, even if it prepares space into an ink tank, or devises the configuration of a lid and copes with leakage, under hot environments, the gas in ink expands and leaks and preventing this thoroughly has the problem that an ink tank becomes large, in a difficult top.
[0012] Then, the place which this invention solves such a trouble and is made into the object is cheap, and dependability is to offer a small high ink jet recording device.
[0013]
[Means for Solving the Problem] In the ink tank by which the ink tank of this invention supplies ink to a recording head said ink tank Ink ****, this ink ****, and the free passage section that opens a recording head for free passage in the first half, The steam transmittance which closes the free passage hole dug so that it might be open for free passage with atmospheric air, and this free passage hole is less than [ 2000 g/m2.24 h-atm ]. And it is characterized by being sealed by

the airtight container in the state of reduced pressure so that gas transmittance may have the closure member of 100cc [/m ] 2.24 or more h-atm and may hold space near [ said ] the free passage hole.

[0014] Moreover, the free passage section in which the manufacture approach of the ink tank of this invention opens ink ****, this ink ****, and a recording head for free passage, It is the manufacture approach of an ink tank of having two or more free passage holes dug so that it might be open for free passage with atmospheric air, and the closure member which closes this free passage hole. A. The process C. steam transmittance which supplies and fills up said ink tank with the process B. ink which decompresses said ink **** through said free passage hole from said free passage hole is below 2000g[/m ]2.24h and atm. And the closure member whose gas transmittance is more than 100 cc/m2.24 h-atm The process D. aforementioned ink tank closed under atmospheric pressure to said free passage hole is put in in a container without permeability, space is prepared between said free passage holes and said well-closed containers, and it is characterized by having the process which decompresses the inside of said container and carries out a seal package.

[0015]

[Function] Since according to the above-mentioned configuration of this invention the conditions of the closure member which there is no leakage of ink in the state of reduced pressure, and carries out gas transparency were found out and vacuum packaging of the space was prepared and carried out between the ink tank and the hermetic container Since the ink in which ink was re-deaerated and was deaerated by the very reliable condition in early stages of the activity of an ink tank by that cause can be supplied to a recording device, nonconformity with the air mixed in an ink supply way at the time of exchange of an ink tank is canceled. Moreover, since ink leaks neither by the time of vacuum packaging and transport, nor the state of preservation, vacuum packaging can be carried out, without spoiling the restoration nature of ink. Since vacuum packaging was carried out after carrying out ** under atmospheric pressure after ink restoration furthermore, a process is simplified. As mentioned above, an ink jet recording device it is reliable and small [ dependability ] and cheap can be offered.

[0016]

[Example] One example of this invention is explained based on a drawing below.

[0017] Drawing 1 is a main sectional view for explaining one example of the ink jet recording apparatus of this invention, and drawing 2 is the decomposition perspective view of the body of the ink tank used for the ink jet recording apparatus of this invention. Drawing 3 shows the perspective view of the body. Moreover, drawing 4 is a block diagram for explaining ink and a detector.

[0018] A platen 1 is approached and the recording head 3 is formed in the carriage 2 which reciprocates a guide shaft 2a top in the direction of arrow-head B along with the platen 1 which is a recording paper conveyance means to rotate in the direction of arrow-head A in order to convey the recording paper, as shown in drawing 3 in one. The ink tank 7 which held form 6a which there is ink **** 6 and becomes the interior from porosity members, such as polyurethane foam, is formed above the recording head 3. As shown in drawing 2 , in this example, the ink tank 7 is divided into three chambers, 6Y, 6M, and 6C, and three ink **** 6 are formed. These chambers of each are filled up with yellow, cyanogen, and the color ink of a Magenta. However, if the class and number of ink change on a design, the number of chambers in the ink tank 7 will be divided into a required number. Moreover, it is also possible to change the volume of each part store according to the consumption of ink.

[0019] As [ of 2 ] drawing 1 , the exterior and the free passage hole 9 open for free passage are formed in the lid 8, and the base-like projection 10 which aims at adhesion with form 6 is formed in the base at the ink tank 7. The ink room 11 which turns caudad from the core of this projection 10, and carries out ejection maintenance of the ink in form 6 is formed. The edge of the ink room 11 is closed by the plug 12 which consists of elastic members, such as rubber. And by inserting in this plug 12 the hollow needle 5 which are a recording head 3 and a free passage member open for free passage through the filter room 4, it is constituted so that the ink which sank in into the ink tank 7 may be supplied to a recording head 3. In addition, the ink room 11 is in the condition of a sealing room with a plug 12 and form 6. Moreover, it is closed till just before an activity by the closure member 21 of the free passage hole 9 which at least one can open, opens just before an activity, and is set to air hole 9a. However, although two or more free passage holes 9 are formed in this example, it is satisfactory for acquiring at least one desired effectiveness in any way. If the approach of pulling, removing and opening the edge using the closure member 21 long enough like drawing 2 is used in order to open, it can open easily. Furthermore, if it joins into the package bag 25 which shows the edge to drawing 6 , when taking out from the package bag 25, it is surely opened, and there are also no problems, such as an opening failure of a user, and it can open certainly. Moreover, projection 31 is formed in the lever 30 for attaching an ink tank like drawing 5 , and when attaching an ink tank, even if it uses the approach of breaking through a lever 30 by the derrick down and this projection 31 in the direction of C, it can open easily. However, if it is the configuration that the closure member 21 can be opened, it is not necessary to open using the instrument of dedication especially.

[0020] The ink tank of this invention has formed the closure member 22 in other free passage holes 9 which are not opened. The steam transmittance of all the closure members 21 and 22 is less than [ 2000 g/m2.24 h-atm ], and at least one gas transmittance uses the thing beyond 100 cc/m2.24 h-atm. gas transmittance -- A of the gas transmittance test method of the plastic film of JIS(Japanese Industrial Standards) K7126, and a sheet -- it captures to law and the transmittance of 23**2-degree C atmospheric air is measured. moreover, steam transmittance -- the plastic film of JIS(Japanese Industrial Standards) K7129, and the conditions of 40 **0.5-degree-C relative humidity difference (90**2) %RH of the steam transmittance test method (device measuring method) of a sheet -- A -- it captures and measures to law. in steam transmittance, it comes out and is [ using the following / 2000 g/m2.24 h-atm ] reasonable so that ink may not leak at the time of transport, and the reason using the thing beyond 100 cc/m2.24 h-atm comes out so that ink may be re-deaerated after vacuum packaging mentioned later. When steam transmittance used for the closure member the cellulose triacetate with a thickness of 13 micrometers whose gas transmittance is 20000 cc/m2.24 h-atm and experimented in it by 2000 g/m2.24h and atm, ink did not leak, and ink was re-deaerated and was able to acquire the effectiveness to expect. Moreover, when gas transmittance used for the closure member the vinylidene chloride copolymer with a thickness of 25 micrometers whose steam transmittance is 3 g/m2.24 h-atm and experimented in it by 100 cc/m2.24 h-atm, ink did not leak, ink was re-deaerated and this was also able to acquire the effectiveness to expect.

[0021] The reason for opening the closure member 21 here and opening air hole 9a is explained. The steam transmittance of all the closure members 21 and 22 is less than [ 2000 g/m2.24 h-atm ]. Since it is about 1,000,000 cc/m2.24 h-atm even if the gas transmittance of such an ingredient is large, and there are few air contents replaced with this gas transmittance in an ink tank to the ink consumption speed of the usual printer activity, the inside of an ink tank becomes negative pressure gradually as a printer is used. If this negative pressure exceeds constant value (i.e., if the

negative pressure exceeding the capillary tube force of the meniscus of the ink formed in the nozzle of a head occurs in an ink tank), it will destroy and a meniscus will become the poor regurgitation of an ink droplet. Therefore, air hole 9a for filling up air corresponding to consumption of ink is needed.

[0022] Moreover, when the poor regurgitation arises in a recording head 3, ink should be attracted from a recording head 3 in operating a suction pump 15 through cap 13 and piping 14. Thereby, recovery action of the poor regurgitation is performed. The attracted ink is sent to waste ink ** 17 through piping 16. In this invention, waste ink ** 17 and the ink tank 7 are another objects, and waste ink ** 17 is arranged in the body of a recording device, and has the composition of usually not being exchanged.

[0023] By the way, the signs S1 and S2 in drawing are ink and an electrode for detection, the electrode S1 of one of these was formed in the internal surface of the ink tank 7 so that form 6 might be contacted, and the hollow needle 5 with which the electrode S2 of another side contacts ink serves as the electrode. O ring 23 made of rubber makes it have bit so that ink may not leak between an electrode S1 and the ink tank 7. And as shown in drawing 4 , the seal of approval of the reference voltage Vcc is carried out to an electrode S1. Moreover, the hollow needle 5 which serves as the electrode S2 of another side is grounded. Furthermore, the resistance variation detector which consists of a differential circuit 19 and a comparison circuit 20 has connected with the electrode S1 of the side to which the seal of approval of the reference voltage Vcc is carried out. And when fixed level with resistance variation is exceeded, it is constituted so that an output signal may be generated.

[0024] Moreover, the record command signal for expulsion of an ink droplet by which a seal of approval is carried out to a recording head 3 is transmitted by FPC (Flexible Print Circuit)18 which is a flexible signal means of communication. And on FPC18, ink and the signal line for detection are wired in one, and it connects with electrodes S1 and S2. In addition, the thing of FPC18 for which FFC (Flexible Flat Cable) etc. may be used for replacing cannot be overemphasized as a signal means of communication. It cannot be overemphasized that you may be the configuration of the two-sheet pile instead of FPC of one more sheet.

[0025] Next, drawing 6 and drawing 7 explain the manufacture and the package approach of an ink tank which were used for this example. The package bag 25 shown in drawing 6 is a package bag made from the very high aluminum laminate film of gas barrier property.

[0026] First, after the approach of filling up the ink tank 7 with ink changes the ink tank 7 into a reduced pressure condition, it supplies ink and performs it. Although the degree of vacuum used for restoration can carry out desired ink restoration with 0.4 or less atmospheric pressures, when the amount of restoration ink and an injection time are taken into consideration, 0.2 or less atmospheric pressures are desirable. At this time, ink is decompressed and turns into deaeration ink. An ink packing effect is a very high approach as how to fill up ink with this reduced pressure condition into a porosity member is explained in JP,60-245560,A.

[0027] Next, the free passage hole 9 is closed by the closure members 21 and 22 under atmospheric pressure. Although what is necessary is just to be also able to perform a process until it results in this activity and this activity under a reduced pressure condition, since there is gas permeability of 100 cc/m2.24 h-atm in at least one of the closure members even if it leaves the ink tank 7 filled up with ink under atmospheric pressure, ink is saturated and it carries out ** under atmospheric pressure, ink is re-deaerated after vacuum packaging of the following process. Although the approach by joining or the binder etc. can be used for the closure approach, the joining is more desirable in order to prevent the leakage of ink. When using a binder, it is

necessary to satisfy the adhesive strength for preventing leakage, detachability, and the property of not being committed by ink. Since they are film which penetrates the air of a molecular level, if gas transmittance and steam transmittance are controlled in the thickness and laminating using resin, selection of an ingredient is easy for the closure members 21 and 22. For example, when a polyethylene terephthalate resin [ not more than 100 cc/m2.24 h-atm / 30 micrometers of polystyrene resin, 20 micrometers of polyethylene resin, and 12 micrometers of polyethylene terephthalate resin ] three-layer laminated film was used for the closure member 21 which can be opened and closed for the film whose gas transmittance is 40 micrometers of polystyrene resin of about 2500 cc/m2.24 h-atm about polystyrene resin at the closure member 22 and ** was made the ink tank 7 in joining, gas transmittance, steam transmittance, the junction force, detachability, and the effectiveness enough expected in reinforcement were acquired.

[0028] Next, after putting the ink tank 7 and a spacer 28 into the package bag 25 and decompressing them like drawing 7 , a seal seal is carried out thoroughly. Space 29 is between the ink tank 7 and the package bag 25. Since, as for this space, the degree of vacuum is high from the inside of the ink tank 7, as for ink, gas transmittance is re-deaerated through the closure member beyond 100 cc/m2.24 h-atm. It is deaerated, even if ink furthermore decomposes during transport of the ink tank 7 and preservation and gas, such as nitrogen and oxygen, occurs. If the member to which air is penetrated like a corrugated fiberboard or urethane foam to a spacer 28, and space exists in the interior is used, even if a spacer 28 sticks to the free passage hole 9, the space in a member will play the role of space 29. Therefore, the configuration of a spacer 28 can be simplified and manufacture and assembly of a spacer 28 become easy. If the degree of vacuum at the time of vacuum packaging is 0.6 or less atmospheric pressures, as it is close to a vacuum, it is better. Next, it is contained by the container 27 (un-illustrating). This condition was [ the seal section 26 of the package bag 25 ] of use in the container 27, and it serves as shock absorbing material. Therefore, it is not necessary to use a special buffer member.

[0029] Here, the relation between the degree of vacuum at the time of vacuum packaging and the nitrogen volume after the retention period in a vacuum-packaging condition is explained. What is necessary is just to be able to control nitrogen volume, since nitrogen volume is the largest although gases other than nitrogen also exist in atmospheric air.

[0030] According to the experiment, by controlling the degree of vacuum at the time of a seal seal to be shown in a table 1, whenever [ deaeration / of the ink in the ink tank 7 immediately after opening a package ] is controllable.

[0031]

[A table 1]

[0032] The percentage of nitrogen volume which has melted into the ink to a saturation value had shown the nitrogen volume in a table 1, and, in the case of the ink used for this example, the

saturation value was about 10-11 ppm. Next, the nitrogen volume in ink explains how whenever [ deaeration / of the ink in the ink tank 7 ] changes the time of manufacture, and after opening. As shown in drawing 8 according to the experiment, it is a period until it leaves and changes vacuum packaging into an atmospheric pressure condition from from immediately after filling up the period to the inside b of drawing with ink. It is about three days from from till Period a immediately after filling up with ink. Vacuum packaging is carried out and the ink in the ink tank 7 is gradually deaerated through the closure member 22 or 21 with large gas transmittance before Period c. When it closes by the closure member to the free passage hole 9 of 2 0.00001m, according to the experiment, the relation between the period which it will take before becoming fixed nitrogen volume after vacuum packaging, and gas transmittance has become as it is shown in a table 2, and the ink in an ink tank is re-deaerated in such a short period that gas transmittance is large.

[0033]

[A table 2]

[0034] When gas permeability used the closure member not more than 100 cc/m2.24 h-atm, the period re-deaerated becomes long and a transport period and a storage time are taken into consideration, since it is possible that it is not enough deaerated at the time of an activity, there is a problem practically. If time amount left under atmospheric pressure is shortened until it carries out ** by the closure members 21 and 22 after being filled up when using a closure [ with a short and transport period ] member with small gas transmittance, the period re-deaerated also becomes short and sufficient dependability can be secured at the time of an activity. or the time of carrying out ** by the closure members 21 and 22 -- alike -- a few -- what is necessary is just to carry out ** under an environment with a degree of vacuum In this case, since the pressure differential of space 29 becomes small in the ink tank 7, it is effective in not separating, even if the bonding strength of the closure members 21 and 22 is small.

[0035] The period to [ out of / c / drawing ] d is a retention period in a package condition. Two years were assumed in the experiment. And nitrogen volume rises one by one from the event among [ after opening / d ] drawing. The nitrogen volume in ink will reach the abbreviation saturation state in [ e ] drawing after opening in about three days. However, according to the experiment, it turned out that the effectiveness by deaeration is expectable about two to four weeks after opening in [ d ] drawing (inside f of drawing). It will be in a perfect saturation state after that, and the effectiveness of deaeration of the ink for which it asks by this invention is lost.

[0036] Here explains the effectiveness by deaeration of ink. In case the ink tank 7 is taken out and inserted to the hollow needle 5, the amount of the air mixed from the hollow needle 5 is very usually a minute amount. In the check by experiment, when the ink inflow aperture of the hollow needle 5 was a diameter of about 0.8mm, even if there were many amounts of the air to mix, they

were below 0.4 cube mm extent for a meniscus. To a recording head 3, is the air mixed once Mukai, and flows, and a trap is reached and carried out to filter 4a in the filter room 4 (un-illustrating). Since this air by which the trap was carried out has the very detailed eye granularity of filter 4a, filter 4a is not passed easily. When the diameter of filter 4a was [ the space width of face in 4mm and the filter room 4 ] about 0.3-0.5mm according to the experiment, even if the count of extraction and insertion of the ink tank 7 carried out 10 - ten numbers, this air did not pass filter 4a by record actuation. In case deaeration ink can be clearly supplied to a recording head 3 during the period to the inside e of drawing 8 if it is mixing of air of this level, and this takes out and inserts the ink tank 7 to the hollow needle 5, the air mixed from the hollow needle 5 melts into ink, and does not pose a problem. However, when left removing the ink tank 7 from the hollow needle 5 in a real activity, it is fully possible. In this case, air mixes in a large quantity. The air mixed when air mixed in the large quantity will close filter 4a, and will bar passage of ink. A recording head 3 becomes the poor regurgitation as the result. In this case, although the suction pump 15 was operated and recovery action of the poor regurgitation was performed, the experiment also showed that a big difference was in recoverability by whenever [ deaeration / of ink ]. If it is ink by about two - four weeks after opening shown in [ f ] drawing 8 , there will be no nonconformity in carrying out attraction clearance of the air in the filter room 4 with a suction pump 15 in any way. However, when it passed over this period, and it changed into the supersaturation condition further and filter 4a was passed with air, as for the air content in ink, it was checked full saturation and that apply to a recording head 3 from filter 4a, and minute air bubbles are generated. It will become the poor regurgitation when these minute air bubbles are in the pressure room of a recording head 3.

[0037] To the air mixed at the time of exchange of the ink tank 7 as explained above, nonconformity which becomes poor [ the regurgitation ] according to the effectiveness of deaeration of ink can be abolished. Moreover, also in the recovery action performed when air collects so much in the filter room 4, recovery action can be ended good according to the effectiveness of deaeration of ink. If the air content in the filter room 4 is below fixed, in order that air may not pass filter 4a with ink, even if it is ink used as the saturation state after among [ e ] drawing 8 , there is no nonconformity in any way at the time of recovery action.

[0038]

[Effect of the Invention] According to this invention, since the ink in an ink tank does not leak, vacuum packaging can be carried out, holding ink in an ink tank without spoiling the restoration nature of ink. Gas penetrates to the closure member prepared in the free passage hole of an ink tank, and since the space where a degree of vacuum is high exists between an ink tank and a container further, ink is re-deaerated. Deaeration ink can be supplied to a recording device in early stages of the activity of an ink tank by that cause, and nonconformity with the air mixed in an ink supply path at the time of exchange of an ink tank is canceled. Moreover, opening of the closure member which closes an ink tank is easy. It has the effectiveness that an ink jet recording device with dependability it is high and small and very cheap can be offered by the above.

## TECHNICAL FIELD

[Industrial Application] This invention relates to the ink tank which fitted the ink jet recording device etc. at the detail more about the ink tank holding ink.

## PRIOR ART

[Description of the Prior Art] An ink jet recording device is equipment which is made to breathe out an ink droplet for the alphabetic character according to recording information etc. from a detailed nozzle, and performs record writing in the record paper. Formation of an ink droplet carries out volume change of the pressure room arranged in the interior of a recording head rapidly by electrostriction vibrator or the electric thermal-conversion component, and is performed by generating a discharge pressure. Therefore, when air mixes in ink supply paths, such as a pressure room, a discharge pressure does not occur good but record writing becomes impossible.

[0003] Moreover, record writing will become impossible, if all the ink in an ink tank is consumed and supply is cut off. And air enters in the ink supply path of resulting in a nozzle, and the problem of taking great time amount by the time record writing is attained, even if it newly supplies ink arises.

[0004] In order to cope with such a problem from the first, before arranging a level detector in an ink tank, or arranging a level detector in a part of ink supply path and cutting off supply of ink, the configuration which detects an ink end is used. It has prevented that air mixes in a large quantity in an ink supply path by that cause at ink and the time. However, it cannot prevent thoroughly that air mixes in an ink supply path at the time of extraction and insertion with the ink tanks at the time of exchange of an ink tank etc., and a recording head.

[0005] Then, what was indicated by JP,3-61592,B is known as a proposal for suppressing the effect of the air conventionally mixed in the ink supply path in first stage at the time of extraction and insertion with an ink tank and a recording head. The ink tank which held the deaerated ink in the very high hermetic container of gas barrier property is held in the state of reduced pressure. In this conventional example, immediately after opening a hermetic container, the ink in an ink tank is deaeration ink, and it is going to remove the effect of the air mixed in the ink supply path in this deaeration ink in first stage.

[0006] Moreover, on an ink tank, it has an injected hole for being filled up with ink, and an air hole for being open for free passage with atmospheric air so that air may flow corresponding to reduction by the activity of ink. The ink with which it filled up in the ink tank will leak from this injected hole and air hole according to factors, such as a position of the ink tank at the time of transport, and environmental temperature. When vacuum packaging especially of the ink tank is carried out, this phenomenon becomes remarkable, so that it changes into a high reduced pressure condition. Therefore, although indicated by JP,4-12834,A, the approach of carrying out and changing vacuum packaging of the degree of vacuum at the time of vacuum packaging into a reduced pressure condition lower than the time of being filled up with ink like is proposed.

[0007] Moreover, in order to prevent the leakage of ink conventionally, what was indicated by JP,54-31897,B is known. Although passage of air is allowed, it has a filter like the poly tetrafluoroethylene which has the penetrated countless narrow path which prevents a liquid flowing in an air hole. In addition, as shown in JP,60-245560,A or a U.S. Pat. No. 4771295 description, what prepares space into an ink tank is known.

## EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, since the ink in an ink tank does not leak, vacuum packaging can be carried out, holding ink in an ink tank without spoiling the restoration nature of ink. Gas penetrates to the closure member prepared in the free passage hole of an ink tank, and since the space where a degree of vacuum is high exists between an ink tank and a container further, ink is re-deaerated. Deaeration ink can be supplied to a recording device in early stages of the activity of an ink tank by that cause, and nonconformity with the air mixed in an ink supply path at the time of exchange of an ink tank is canceled. Moreover, opening of the closure member which closes an ink tank is easy. It has the effectiveness that an ink jet recording device with dependability it is high and small and very cheap can be offered by the above.

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the more, in the conventional example, the more reduced pressure is large, although dependability is securable, reduced pressure follows it on becoming large, and ink leakage-comes to maintain whenever [ deaeration / of ink ], and to be easy of dependability from an injected hole. Moreover, if vacuum packaging is carried out after adding the impact of being as drop ****, since ink will leak by slight reduced pressure, workability is bad. If there is furthermore a temperature change, ink will leak by expansion of the gas in ink. In order to prevent the leakage of ink, when the fill of ink is reduced and a charging efficiency is dropped, there is a problem that an ink tank becomes large.

[0009] Moreover, in the conventional example shown in order to prevent leakage, although there is no leakage of ink under atmospheric pressure, if it packs only in the state of the reduced pressure which can secure sufficient dependability, ink will ooze from a closure member. The gas transmittance of a closure member is too high, that is, it is because it is the filter with which the countless small hole exists in the closure member.

[0010] Since it will not be re-deaerated at the time of vacuum packaging although there is no leakage of ink if the member which does not have gas transparency in this closure member is used, in order to supply deaeration ink, or it performed all processes under reduced pressure, when the process under atmospheric pressure must be performed upwards for a short time, ink decomposes and gas occurs, there is a problem that it will be saturated again.

[0011] Moreover, even if it prepares space into an ink tank, or devises the configuration of a lid and copes with leakage, under hot environments, the gas in ink expands and leaks and preventing this thoroughly has the problem that an ink tank becomes large, in a difficult top.

[0012] Then, the place which this invention solves such a trouble and is made into the object is cheap, and dependability is to offer a small high ink jet recording device.

## MEANS

[Means for Solving the Problem] In the ink tank by which the ink tank of this invention supplies ink to a recording head said ink tank Ink ****, this ink ****, and the free passage section that opens a recording head for free passage in the first half, The steam transmittance which closes

the free passage hole dug so that it might be open for free passage with atmospheric air, and this free passage hole is less than [ 2000 g/m2.24 h-atm ]. And it is characterized by being sealed by the airtight container in the state of reduced pressure so that gas transmittance may have the closure member of 100cc [/m ] 2.24 or more h-atm and may hold space near [ said ] the free passage hole.

[0014] Moreover, the free passage section in which the manufacture approach of the ink tank of this invention opens ink ****, this ink ****, and a recording head for free passage, It is the manufacture approach of an ink tank of having two or more free passage holes dug so that it might be open for free passage with atmospheric air, and the closure member which closes this free passage hole. A. The process C. steam transmittance which supplies and fills up said ink tank with the process B. ink which decompresses said ink **** through said free passage hole from said free passage hole is below 2000g[/m ]2.24h and atm. And the closure member whose gas transmittance is more than 100 cc/m2.24 h-atm The process D. aforementioned ink tank closed under atmospheric pressure to said free passage hole is put in in a container without permeability, space is prepared between said free passage holes and said well-closed containers, and it is characterized by having the process which decompresses the inside of said container and carries out a seal package.

## OPERATION

[Function] Since according to the above-mentioned configuration of this invention the conditions of the closure member which there is no leakage of ink in the state of reduced pressure, and carries out gas transparency were found out and vacuum packaging of the space was prepared and carried out between the ink tank and the hermetic container, Since the ink in which ink was re-deaerated and was deaerated by the very reliable condition in early stages of the activity of an ink tank by that cause can be supplied to a recording device, nonconformity with the air mixed in an ink supply way at the time of exchange of an ink tank is canceled. Moreover, since ink leaks neither by the time of vacuum packaging and transport, nor the state of preservation, vacuum packaging can be carried out, without spoiling the restoration nature of ink. Since vacuum packaging was carried out after carrying out ** under atmospheric pressure after ink restoration furthermore, a process is simplified. As mentioned above, an ink jet recording device it is reliable and small [ dependability ] and cheap can be offered.

## EXAMPLE

[Example] One example of this invention is explained based on a drawing below.

[0017] Drawing 1 is a main sectional view for explaining one example of the ink jet recording apparatus of this invention, and drawing 2 is the decomposition perspective view of the body of the ink tank used for the ink jet recording apparatus of this invention. Drawing 3 shows the perspective view of the body. Moreover, drawing 4 is a block diagram for explaining ink and a detector.

[0018] A platen 1 is approached and the recording head 3 is formed in the carriage 2 which reciprocates a guide shaft 2a top in the direction of arrow-head B along with the platen 1 which

is a recording paper conveyance means to rotate in the direction of arrow-head A in order to convey the recording paper, as shown in drawing 3 in one. The ink tank 7 which held form 6a which there is ink **** 6 and becomes the interior from porosity members, such as polyurethane foam, is formed above the recording head 3. As shown in drawing 2 , in this example, the ink tank 7 is divided into three chambers, 6Y, 6M, and 6C, and three ink **** 6 are formed. These chambers of each are filled up with yellow, cyanogen, and the color ink of a Magenta. However, if the class and number of ink change on a design, the number of chambers in the ink tank 7 will be divided into a required number. Moreover, it is also possible to change the volume of each part store according to the consumption of ink.

[0019] As [ of 2 ] drawing 1 , the exterior and the free passage hole 9 open for free passage are formed in the lid 8, and the base-like projection 10 which aims at adhesion with form 6 is formed in the base at the ink tank 7. The ink room 11 which turns caudad from the core of this projection 10, and carries out ejection maintenance of the ink in form 6 is formed. The edge of the ink room 11 is closed by the plug 12 which consists of elastic members, such as rubber. And by inserting in this plug 12 the hollow needle 5 which are a recording head 3 and a free passage member open for free passage through the filter room 4, it is constituted so that the ink which sank in into the ink tank 7 may be supplied to a recording head 3. In addition, the ink room 11 is in the condition of a sealing room with a plug 12 and form 6. Moreover, it is closed till just before an activity by the closure member 21 of the free passage hole 9 which at least one can open, opens just before an activity, and is set to air hole 9a. However, although two or more free passage holes 9 are formed in this example, it is satisfactory for acquiring at least one desired effectiveness in any way. If the approach of pulling, removing and opening the edge using the closure member 21 long enough like drawing 2 is used in order to open, it can open easily. Furthermore, if it joins into the package bag 25 which shows the edge to drawing 6 , when taking out from the package bag 25, it is surely opened, and there are also no problems, such as an opening failure of a user, and it can open certainly. Moreover, projection 31 is formed in the lever 30 for attaching an ink tank like drawing 5 , and when attaching an ink tank, even if it uses the approach of breaking through a lever 30 by the derrick down and this projection 31 in the direction of C, it can open easily. However, if it is the configuration that the closure member 21 can be opened, it is not necessary to open using the instrument of dedication especially.

[0020] The ink tank of this invention has formed the closure member 22 in other free passage holes 9 which are not opened. The steam transmittance of all the closure members 21 and 22 is less than [ 2000 g/m2.24 h-atm ], and at least one gas transmittance uses the thing beyond 100 cc/m2.24 h-atm. gas transmittance -- A of the gas transmittance test method of the plastic film of JIS(Japanese Industrial Standards) K7126, and a sheet -- it captures to law and the transmittance of 23**2-degree C atmospheric air is measured. moreover, steam transmittance -- the plastic film of JIS(Japanese Industrial Standards) K7129, and the conditions of 40 **0.5-degree-C relative humidity difference (90**2) %RH of the steam transmittance test method (device measuring method) of a sheet -- A -- it captures and measures to law. in steam transmittance, it comes out and is [ using the following / 2000 g/m2.24 h-atm ] reasonable so that ink may not leak at the time of transport, and the reason using the thing beyond 100 cc/m2.24 h-atm comes out so that ink may be re-deaerated after vacuum packaging mentioned later. When steam transmittance used for the closure member the cellulose triacetate with a thickness of 13 micrometers whose gas transmittance is 20000 cc/m2.24 h-atm and experimented in it by 2000 g/m2.24h and atm, ink did not leak, and ink was re-deaerated and was able to acquire the effectiveness to expect. Moreover, when gas transmittance used for the closure member the vinylidene chloride

copolymer with a thickness of 25 micrometers whose steam transmittance is 3 g/m2.24 h-atm and experimented in it by 100 cc/m2.24 h-atm, ink did not leak, ink was re-deaerated and this was also able to acquire the effectiveness to expect.

[0021] The reason for opening the closure member 21 here and opening air hole 9a is explained. The steam transmittance of all the closure members 21 and 22 is less than [ 2000 g/m2.24 h-atm ]. Since it is about 1,000,000 cc/m2.24 h-atm even if the gas transmittance of such an ingredient is large, and there are few air contents replaced with this gas transmittance in an ink tank to the ink consumption speed of the usual printer activity, the inside of an ink tank becomes negative pressure gradually as a printer is used. If this negative pressure exceeds constant value (i.e., if the negative pressure exceeding the capillary tube force of the meniscus of the ink formed in the nozzle of a head occurs in an ink tank), it will destroy and a meniscus will become the poor regurgitation of an ink droplet. Therefore, air hole 9a for filling up air corresponding to consumption of ink is needed.

[0022] Moreover, when the poor regurgitation arises in a recording head 3, ink should be attracted from a recording head 3 in operating a suction pump 15 through cap 13 and piping 14. Thereby, recovery action of the poor regurgitation is performed. The attracted ink is sent to waste ink ** 17 through piping 16. In this invention, waste ink ** 17 and the ink tank 7 are another objects, and waste ink ** 17 is arranged in the body of a recording device, and has the composition of usually not being exchanged.

[0023] By the way, the signs S1 and S2 in drawing are ink and an electrode for detection, the electrode S1 of one of these was formed in the internal surface of the ink tank 7 so that form 6 might be contacted, and the hollow needle 5 with which the electrode S2 of another side contacts ink serves as the electrode. O ring 23 made of rubber makes it have bit so that ink may not leak between an electrode S1 and the ink tank 7. And as shown in drawing 4 , the seal of approval of the reference voltage Vcc is carried out to an electrode S1. Moreover, the hollow needle 5 which serves as the electrode S2 of another side is grounded. Furthermore, the resistance variation detector which consists of a differential circuit 19 and a comparison circuit 20 has connected with the electrode S1 of the side to which the seal of approval of the reference voltage Vcc is carried out. And when fixed level with resistance variation is exceeded, it is constituted so that an output signal may be generated.

[0024] Moreover, the record command signal for expulsion of an ink droplet by which a seal of approval is carried out to a recording head 3 is transmitted by FPC (Flexible Print Circuit)18 which is a flexible signal means of communication. And on FPC18, ink and the signal line for detection are wired in one, and it connects with electrodes S1 and S2. In addition, the thing of FPC18 for which FFC (Flexible Flat Cable) etc. may be used for replacing cannot be overemphasized as a signal means of communication. It cannot be overemphasized that you may be the configuration of the two-sheet pile instead of FPC of one more sheet.

[0025] Next, drawing 6 and drawing 7 explain the manufacture and the package approach of an ink tank which were used for this example. The package bag 25 shown in drawing 6 is a package bag made from the very high aluminum laminate film of gas barrier property.

[0026] First, after the approach of filling up the ink tank 7 with ink changes the ink tank 7 into a reduced pressure condition, it supplies ink and performs it. Although the degree of vacuum used for restoration can carry out desired ink restoration with 0.4 or less atmospheric pressures, when the amount of restoration ink and an injection time are taken into consideration, 0.2 or less atmospheric pressures are desirable. At this time, ink is decompressed and turns into deaeration ink. An ink packing effect is a very high approach as how to fill up ink with this reduced

pressure condition into a porosity member is explained in JP,60-245560,A.
[0027] Next, the free passage hole 9 is closed by the closure members 21 and 22 under atmospheric pressure. Although what is necessary is just to be also able to perform a process until it results in this activity and this activity under a reduced pressure condition, since there is gas permeability of 100 cc/m2.24 h-atm in at least one of the closure members even if it leaves the ink tank 7 filled up with ink under atmospheric pressure, ink is saturated and it carries out ** under atmospheric pressure, ink is re-deaerated after vacuum packaging of the following process. Although the approach by joining or the binder etc. can be used for the closure approach, the joining is more desirable in order to prevent the leakage of ink. When using a binder, it is necessary to satisfy the adhesive strength for preventing leakage, detachability, and the property of not being committed by ink. Since they are film which penetrates the air of a molecular level, if gas transmittance and steam transmittance are controlled in the thickness and laminating using resin, selection of an ingredient is easy for the closure members 21 and 22. For example, when a polyethylene terephthalate resin [ not more than 100 cc/m2.24 h-atm / 30 micrometers of polystyrene resin, 20 micrometers of polyethylene resin, and 12 micrometers of polyethylene terephthalate resin ] three-layer laminated film was used for the closure member 21 which can be opened and closed for the film whose gas transmittance is 40 micrometers of polystyrene resin of about 2500 cc/m2.24 h-atm about polystyrene resin at the closure member 22 and ** was made the ink tank 7 in joining, gas transmittance, steam transmittance, the junction force, detachability, and the effectiveness enough expected in reinforcement were acquired.
[0028] Next, after putting the ink tank 7 and a spacer 28 into the package bag 25 and decompressing them like drawing 7 , a seal seal is carried out thoroughly. Space 29 is between the ink tank 7 and the package bag 25. Since, as for this space, the degree of vacuum is high from the inside of the ink tank 7, as for ink, gas transmittance is re-deaerated through the closure member beyond 100 cc/m2.24 h-atm. It is deaerated, even if ink furthermore decomposes during transport of the ink tank 7 and preservation and gas, such as nitrogen and oxygen, occurs. If the member to which air is penetrated like a corrugated fiberboard or urethane foam to a spacer 28, and space exists in the interior is used, even if a spacer 28 sticks to the free passage hole 9, the space in a member will play the role of space 29. Therefore, the configuration of a spacer 28 can be simplified and manufacture and assembly of a spacer 28 become easy. If the degree of vacuum at the time of vacuum packaging is 0.6 or less atmospheric pressures, as it is close to a vacuum, it is better. Next, it is contained by the container 27 (un-illustrating). This condition was [ the seal section 26 of the package bag 25 ] of use in the container 27, and it serves as shock absorbing material. Therefore, it is not necessary to use a special buffer member.
[0029] Here, the relation between the degree of vacuum at the time of vacuum packaging and the nitrogen volume after the retention period in a vacuum-packaging condition is explained. What is necessary is just to be able to control nitrogen volume, since nitrogen volume is the largest although gases other than nitrogen also exist in atmospheric air.
[0030] According to the experiment, by controlling the degree of vacuum at the time of a seal seal to be shown in a table 1, whenever [ deaeration / of the ink in the ink tank 7 immediately after opening a package ] is controllable.
[0031]
[A table 1]

[0032] The percentage of nitrogen volume which has melted into the ink to a saturation value had shown the nitrogen volume in a table 1, and, in the case of the ink used for this example, the saturation value was about 10-11 ppm. Next, the nitrogen volume in ink explains how whenever [ deaeration / of the ink in the ink tank 7 ] changes the time of manufacture, and after opening. As shown in drawing 8 according to the experiment, it is a period until it leaves and changes vacuum packaging into an atmospheric pressure condition from from immediately after filling up the period to the inside b of drawing with ink. It is about three days from from till Period a immediately after filling up with ink. Vacuum packaging is carried out and the ink in the ink tank 7 is gradually deaerated through the closure member 22 or 21 with large gas transmittance before Period c. When it closes by the closure member to the free passage hole 9 of 2 0.00001m, according to the experiment, the relation between the period which it will take before becoming fixed nitrogen volume after vacuum packaging, and gas transmittance has become as it is shown in a table 2, and the ink in an ink tank is re-deaerated in such a short period that gas transmittance is large.
[0033]
[A table 2]

[0034] When gas permeability used the closure member not more than 100 cc/m2.24 h-atm, the period re-deaerated becomes long and a transport period and a storage time are taken into consideration, since it is possible that it is not enough deaerated at the time of an activity, there is a problem practically. If time amount left under atmospheric pressure is shortened until it carries out ** by the Ushiro closure members 21 and 22 with which it was filled up when using a closure [ with a short and transport period ] member with small gas transmittance, the period re-deaerated also becomes short and sufficient dependability can be secured at the time of an activity. or the time of carrying out ** by the closure members 21 and 22 -- alike -- a few -- what is necessary is just to carry out ** under an environment with a degree of vacuum In this case, since the pressure differential of space 29 becomes small in the ink tank 7, it is effective in not

separating, even if the bonding strength of the closure members 21 and 22 is small.
[0035] The period to [ out of / c / drawing ] d is a retention period in a package condition. Two years were assumed in the experiment. And nitrogen volume rises one by one from the event among [ of opening Ushiro / d ] drawing. The nitrogen volume in ink will reach the abbreviation saturation state in [ e ] drawing after opening in about three days. However, according to the experiment, it turned out that the effectiveness by deaeration is expectable about two to four weeks from opening Ushiro in [ d ] drawing (inside f of drawing). It will be in a perfect saturation state after that, and the effectiveness of deaeration of the ink for which it asks by this invention is lost.
[0036] Here explains the effectiveness by deaeration of ink. In case the ink tank 7 is taken out and inserted to the hollow needle 5, the amount of the air mixed from the hollow needle 5 is very usually a minute amount. In the check by experiment, when the ink inflow aperture of the hollow needle 5 was a diameter of about 0.8mm, even if there were many amounts of the air to mix, they were below 0.4 cube mm extent for a meniscus. The air mixed once flows toward a recording head 3, and a trap is reached and carried out to filter 4a in the filter room 4 (un-illustrating). Since this air by which the trap was carried out has the very detailed eye granularity of filter 4a, filter 4a is not passed easily. When the diameter of filter 4a was [ the space width of face in 4mm and the filter room 4 ] about 0.3-0.5mm according to the experiment, even if the count of extraction and insertion of the ink tank 7 carried out 10 - ten numbers, this air did not pass filter 4a by record actuation. In case deaeration ink can be clearly supplied to a recording head 3 during the period to the inside e of drawing 8 if it is mixing of air of this level, and this takes out and inserts the ink tank 7 to the hollow needle 5, the air mixed from the hollow needle 5 melts into ink, and does not pose a problem. However, when left removing the ink tank 7 from the hollow needle 5 in a real activity, it is fully possible. In this case, air mixes in a large quantity. The air mixed when air mixed in the large quantity will close filter 4a, and will bar passage of ink. A recording head 3 becomes the poor regurgitation as the result. In this case, although the suction pump 15 was operated and recovery action of the poor regurgitation was performed, the experiment also showed that a big difference was in recoverability by whenever [ deaeration / of ink ]. If it is ink by about two - four weeks after opening shown in [ f ] drawing 8 , there will be no nonconformity in carrying out attraction clearance of the air in the filter room 4 with a suction pump 15 in any way. However, when it passed over this period, and it changed into the supersaturation condition further and filter 4a was passed with air, as for the air content in ink, it was checked full saturation and that apply to a recording head 3 from filter 4a, and minute air bubbles are generated. It will become the poor regurgitation when these minute air bubbles are in the pressure room of a recording head 3.
[0037] To the air mixed at the time of exchange of the ink tank 7 as explained above, nonconformity which becomes poor [ the regurgitation ] according to the effectiveness of deaeration of ink can be abolished. Moreover, also in the recovery action performed when air collects so much in the filter room 4, recovery action can be ended good according to the effectiveness of deaeration of ink. If the air content in the filter room 4 is below fixed, in order that air may not pass filter 4a with ink, even if it is ink used as the saturation state after among [ e ] drawing 8 , there is no nonconformity in any way at the time of recovery action.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The main sectional view for explaining one example of the ink jet recording device of this invention.
[Drawing 2] The decomposition perspective view of the body of the ink tank used for the ink jet recording device of this invention.
[Drawing 3] The perspective view of the body of the ink jet recording device of this invention.
[Drawing 4] The block diagram for explaining ink and a detector.
[Drawing 5] The perspective view of the body of the ink jet recording device of this invention.
[Drawing 6] The perspective view for explaining the ink tank by which vacuum packaging was carried out.
[Drawing 7] The sectional view for explaining the inside of a reduced pressure container.
[Drawing 8] Drawing having shown the amount of nitrogen transparency, and the relation of time amount.
[Description of Notations]
1 .... Platen
2 .... Carriage
3 .... Recording Head
4 .... Filter Room
5 .... Hollow Needle
7 .... Ink Tank
9 .... Free Passage Hole
9a .... Air hole
13 .... Cap
15 .... Suction pump
17 .... Waste ink **
19 .... Differential circuit
20 .... Comparison circuit
21 .... Closure member which can be opened
22 .... Closure member
25 .... Package bag
26 .... Seal section
28 .... Spacer
29 .... Space
S1 .... Electrode
S2 .... Electrode